BOOM PECAN SPRAYERS

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Orchard herbicide sprayers must be able to efficiently place herbicides on the orchard floor with minimal risk to the trees. Successful orchard herbicide application requires: appropriate herbicide selection; proper timing of applications; and correctly adjusted, calibrated, and operated spray equipment. Boom sprayers are the predominant orchard herbicide sprayers. They operate at low spray pressure and volume. Sprayers can be mounted on or pulled behind a tractor. Figure 1 depicts a well-conceived sprayer design.

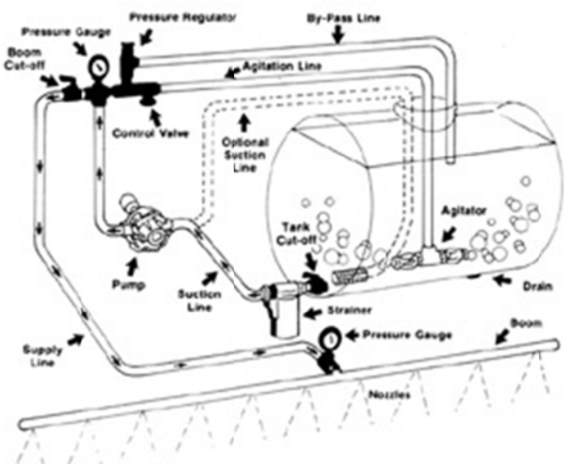

Figure 1. Components of a properly designed weed control sprayer.

COMPONENTS

Tanks of plastic-lined or corrosion-resistant metals and fiberglass are available in a variety of sizes. Sprayer tanks should have a large filling hole to facilitate easy filling, inspection, and cleaning of the tank. A strainer is needed to filter out debris, which is easily introduced during loading. Tanks should also have drains to facilitate fast, complete drainage, without exposing workers to herbicide.

Strainers are especially important when wettable powders are applied. Fifty- to 100-mesh screens are appropriate for both in-line and nozzle strainers. Strainers should be provided in the locations shown in Figure 1. In-line strainers can be provided as optional equipment.

Orchard herbicides are most often mixed with water and applied at an appropriately diluted concentration. Agitators of several designs provide the turbulence needed to keep herbicides properly mixed. Liquid concentrates, emulsions, and soluble powder formulations require little agitation to maintain a good sprayable solution. Wettable powders require vigorous agitation because they readily settle out. The bypass hose agitation alone normally does not furnish enough agitation for wettable powders. Jet agitators, sometimes referred to as hydraulic boosters, should be used to maintain proper agitation.

Pumps of four designs (roller, centrifugal, piston, and diaphragm) are common on herbicide sprayers. Three factors should be considered in selecting pumps for herbicide sprayers: capacity, pressure, and resistance to corrosion and wear. Each pump design offers advantages and disadvantages.

Pump capacity should be sufficient to readily supply the boom output, provide agitation, and offset pump wear. If hydraulic, or jet, agitation is used, allow at least 5-7 GPM for each 100 gallons of tank capacity to provide mixing action. Suitable agitation can also be obtained by pumping 2 GPM per 100 gallons of tank capacity through a siphon, or venturi, agitator that increases the flow through the agitator by 2.5 times. Of course, mechanical agitation does not require any pump capacity. Finally, add 20 to 25 percent to spraying and agitation requirements to compensate for loss of power from pump wear.

The pressure control system of a sprayer consists of a pressure regulator, pressure gauge, and cutoff valve. These components should be within easy reach of the driver. The pressure regulator controls the pressure to nozzles and relieves excess pressure, which allows some of the liquid to return to the tank through the bypass hose. For low-pressure sprayers, a pressure gauge with a 0 to 100 PSI range is desirable. A quick-acting cutoff valve handy to the driver is also necessary on a sprayer. Often, valves are provided so that the side and center sections of the boom can be cut off independently.

Boom sprayers get their name from the booms or long spray-bearing arms that extend laterally to cover a particular swath as the sprayer passes over the field. Booms may be “wet” or “dry.” Wet booms use the material of the boom as the conduit for the spray liquid. Pipes or rigid tubes through which the material passes are utilized. Dry booms have a rigid boom constructed of angle iron, channel iron, or pipes to which hoses and fittings carrying the spray liquid are attached. The spray material passes through the hoses and not the boom itself. Dry boom sprayers are more common. Flexible nozzle spacing, ease of repairs, and cost favor dry booms.

Nozzles meter flow, atomize the liquid in a targeted range of droplet sizes, and disperse the droplets in a specific pattern for proper impact with plants or soil. Nozzles are available in brass, polymer, stainless steel, hardened stainless steel, and ceramic. Brass and polymer nozzles are most popular, primarily due to low cost. Stainless steel and hardened stainless steel nozzles last three to 15 times longer than brass. Ceramic nozzles last about 100 times longer than brass.

Herbicide nozzles should provide uniform distribution of spray solution and develop a large droplet to minimize drift. Nozzles commonly used for broadcast herbicide applications include the regular flat fan, extended-range flat fan, drift-reduction flat fan, turbo flat fan, twin flat fan, and air-induction flat fan.

Operating pressure varies with nozzle type. Tips such as the extended-range flat fan and turbo flat fan nozzles are designed for operating pressures from 15 to 30 PSI, which reduce drift by producing large droplets that are dispersed under low spray pressure. Drift-reduction flat fan and air-induction flat fan nozzles are operated at pressures of 30 PSI or more. These tips are designed to produce larger spray droplets to minimize drift at their specified operating pressures. Operating nozzle tips at other than the specified pressures may result in a poor pattern and less than desirable pattern overlap.

Figure 2A. Flat fan nozzles should be angled at approximately 5% from parallel to the boom. All nozzles should be turned the same direction. Graphics by Will Hampton.

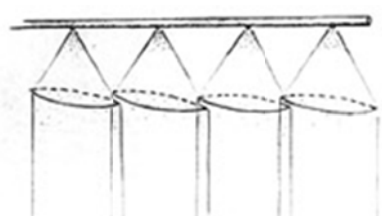

Figure 2B. Angling nozzles assures a similar deposition of spray material all along the spray band, without the particles shearing and drift potential seen when the edges of spray patterns collide in the air. Graphics by Will Hampton.

Spray angle of nozzles also impacts drift potential. Tips that produce a broader pattern (110 °) are preferred because they can be operated closer to the application target, which minimizes drift by shortening the distance spray solution travels. Flat fan nozzles should be uniformly spaced to provide 50 to 60 percent overlap. Table 1 suggests boom heights for flat fan nozzles with different angles. Spray particles that encounter one another while in flight to the ground are drift prone. To avoid this disruption, the orientation of each flat fan along the boom should be angled, or canted, at an angle of 5 degrees from the center line of the boom (Figure 2A) to produce the desired 50 to 60 percent overlap in spray on the ground without intersection of spray from individual nozzles (Figure 2B).

Table 1. Suggested minimum spray nozzle height (flat fan).

Spray Tip Angle	Nozzle Height (Inches) [1]	
	20” Spacing	30” Spacing
65	22 - 24	33 - 35
80	17 - 19	26 - 28
110	10 - 12	14 - 18

1 Nozzle height should be adjusted so that spray pattern overlaps 50-60 percent.

CALIBRATION OF BOOM SPRAYERS

Calibration of sprayer equipment is very important. Inaccurate calibration can cost money and may cause crop damage. Sprayers should be calibrated often to guard against using excessive amounts of pesticides, which may occur as nozzle wear progresses. Safety and economics dictate calibrating with water alone. Care should be taken while working with sprayers and pesticides in the field. *A plastic jug of clean water should always be carried on the tractor in case of pesticide contamination* .

In orchards, herbicide strip applications normally spray 100% of the orchard floor beneath the trees' drip line. To determine the sprayed acreage (herbicide strips), divide the herbicide strip width by the tree row width, then multiply by the total acres of trees. This calculation will yield the actual number of acres in the herbicide-treated strip beneath the trees.

Calibration Procedure

The procedure below is based on spraying 1/128 of an acre per nozzle or row spacing, and collecting the spray that would be released during the time it takes to spray the area. Because there are 128 ounces of liquid in 1 gallon, this convenient relationship results in ounces of liquid collected being directly equal to the application rate in gallons per acre.

Use clean water when calibrating sprayers for applying pesticides that are to be mixed with water. Check uniformity of nozzle output across the boom. Collect from each nozzle for a known time period to ensure each is within 10 percent of the average output. Insert new nozzles if necessary. When applying materials that are appreciably different from water in weight or flow characteristics, such as fertilizer solutions, for example, calibrate with the material to be applied. Exercise extreme care and use protective equipment whenever calibrating sprayers with an active ingredient.

Table 2. Calibration distances with corresponding widths (To determine the distance for spacing or band width not listed, divide the spacing or band width expressed in feet into 340.3. Example: for a 13” band the calibration distance would be 340.3 divided by 13”/12” = 314.1.)

Nozzle Spacing (Inches	Calibration Distance (Feet)
48	85
36	113
30	136
24	170
20	204
18	227
16	255
14	292
12	340
10	408

Step 1. From Table 2, determine the distance to drive in the field (two or more runs suggested). For broadcast spraying (typically 100% of the area beneath the trees' drip line) measure the distance between nozzles.

Step 2. With all equipment attached and operating, measure the time (seconds) to drive the required distance. Make note of throttle setting and gear.

Step 3. With the sprayer sitting still and operating at same throttle setting or *engine RPM* as used in Step 2, adjust pressure to the desired setting. *Machine must be operated at same pressure used for calibration.*

Step 4. Collect spray from one nozzle for the number of seconds required to travel the calibration distance.

Step 5. Measure the amount of liquid collected in fluid ounces. The number of ounces collected is the gallons per acre rate on the coverage basis indicated. For example, if you collect 18 ounces, the sprayer will apply 18 gallons per acre. Adjust applicator speed, pressure, and nozzle size to obtain desired spray volume. If speed is adjusted, start at Step 2 and recalibrate. If pressure or nozzles are changed, start at Step 3 and recalibrate.

Step 6. Verify that all nozzles along the spray boom are delivering the same volume (+/- 5–10%).

Step 7. To determine the amount of pesticide to put into a sprayer tank, divide the total number of gallons of mixture to be made (tank capacity for a full tank) by the spray output in gallons per acre (Step 5) and use the recommended amount of pesticide for this number of acres.

Step 8. Sprayers should be checked frequently for proper calibration.

Sprayer calibration sheets and wallet-size cards are available from your local county extension office or on the web at http://www.ugaspray.org .